MathSoft

S-PLUS 5 FOR UNIX
INSTALLATION AND MAINTENANCE GUIDE

May 1999

Data Analysis Products Division
MathSoft, Inc.
Seattle, Washington

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HOW TO USE THIS BOOK

S-PLUS is a rich programming environment for data analysis. S-PLUS emphasizes graphical methods for exploratory data analysis (EDA), statistical methods, and presentation graphics. S-PLUS provides data analysis tools consisting of a wide variety of functions for statistical and mathematical analysis, and it is a rich language for defining and analyzing statistical models.

This manual provides the information you need to install, update, customize, and maintain S-PLUS on your system. Whether you are the system administrator for a large computer network or the user of a single workstation, this manual contains all the information you need to set up S-PLUS at your site.

WHAT'S IN THIS BOOK?

In this manual, you will learn how to perform the following tasks:

- Install S-PLUS. A simple, step-by-step procedure for installing S-PLUS is provided in Chapter 1, Basic S-Plus Installation. Additional details are provided in Chapter 2, Reading the Media and Obtaining a License Key, and Chapter 3, Installing S-Plus.
- Configure S-PLUS with appropriate system defaults for your particular site (Chapter 4).
- Use S-PLUS license manager features (Chapter 5).
- Set Motif defaults (Chapter 6).
- Customize your local installation (Chapter 7).

TYPOGRAPHIC CONVENTIONS

This manual obeys the following typographic conventions:

- *This font* is used for emphasis and also for user-supplied variables within the UNIX operating system and S-PLUS commands. For example, here is an emphasized passage:

  All objects have implicit, defining, and optional *attributes*.

  Here is a line requesting a user-supplied variable:

  ```
  options(editor="editor")
  ```

- `This font` is used for operating system commands and filenames. For example:

  ```
  Splus5 LICENSE
  ```

Warning...

When you see a Warning box like this, you are seeing a warning about S-PLUS behavior. Read these warnings carefully.

Hint

When you see a Hint box like this, you are getting a peek ahead into more sophisticated use of S-PLUS.

RECOMMENDED ENVIRONMENTS FOR RUNNING S-PLUS

Please review the recommended system requirements for running S-PLUS in the Release Notes. The compilers, X11 version, and Motif version used to build each platform's release are also shown in the Release Notes.

S-PLUS TECHNICAL SUPPORT

North America

For *license keys*, send all required information by e-mail to

ssr@statsci.com

or fax the required information to

206.283-8691

To contact technical support, call

206.283.8802 ext. 235

or fax to

206.283.6310

or send e-mail to

support@statsci.com

Outside North America

For license keys or technical support, contact your distributor. Point your browser to **http://www.MathSoft.com/howtocon/internatl.html** for up-to-date contact information.

If you cannot find a distributor for your location, contact MathSoft International:

Telephone: +44 1276 475350

Fax: +44 1276 451224

E-mail: shelp@mathsoft.co.uk

COMMENTS?

We want our documentation to be useful, and we want it to address your needs. If you have any comments on this or any MathSoft document, please send electronic mail to the following address:

doc@statsci.com

We'd love to hear from you.

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In most configurations, installing S-PLUS is a simple process, particularly for new installations. This chapter describes this simple process. If you encounter difficulties in following this simple procedure, read the troubleshooting section that immediately follows the basic installation instructions. This points out the most common problems with both new and update installations and gives cross-references to the detailed explanations in later chapters that can solve those problems.

Installing S-PLUS should take less than half an hour, although in most cases you will have to allow two separate sessions to complete the installation. S-PLUS (and most S-PLUS add-on modules) runs under a license manager which requires you to have a key generated from information about your UNIX host.

In your first installation session, you create a directory to hold the S-PLUS files, set appropriate permissions for the directory, read the S-PLUS files from the distribution CD-ROM or tape, then run the `HOSTINFO` script supplied to obtain the information necessary to generate the key, and fax that information to MathSoft or your S-PLUS distributor. When you receive your license key, you can proceed to the second installation session, in which you can modify various system configuration options, install the S-PLUS script, and move any libraries or modules from an existing S-PLUS installation to the new version 5.1 location.

The instructions discuss both *new* installations, for those who do not already have S-PLUS installed on their system, and *update* installations, for those who have some version of S-PLUS installed already. In both cases, we *strongly* recommend that you create a new directory (`SHOME`) for S-PLUS version 5.1.

Before attempting to install S-PLUS, you should decide which user account will own the S-PLUS files. On many systems, it makes sense to create an `splus` account to own the S-PLUS files. With such an account, you can be sure that the S-PLUS system administrator can make future configuration changes to S-PLUS without having *root*, or *superuser*, privileges. If your system has such an account, you should perform the installation from that account. However, the final stage of installation requires that several files be copied, typically to directories normally owned by `root`. To copy the files to the directories owned by `root`, you need to use the `su` command to get root permissions before performing this step.

We have attempted to make the installation of S-PLUS as easy as possible, and the instructions in this manual will walk you through all the necessary steps. Please follow the instructions carefully. If, after completing the installation instructions as directed, you have not successfully installed S-PLUS, please call your distributor or MathSoft Technical Support. See the section S-PLUS Technical Support on page vii for contact information.

BASIC INSTALLATION PROCEDURE

To install S-PLUS, use the following procedure. You can omit any step labeled *OPTIONAL STEP* provided you have appropriate file permissions to accept the system defaults.

1. Create a top-level directory for S-PLUS. The top-level directory is called the S-PLUS *SHOME*. The SHOME must be on a file system with at least 100MB of free disk space. Use the UNIX `df` command to determine the disk space available on your system.

   For further details on preparing the top-level directory, see Step 1, Preparing the S-PLUS Top-Level Directory in Chapter 2.

2. Set the UNIX file permissions so that all users can use S-PLUS. Use the following command:

   ```
   umask 022
   ```

3. Read the S-PLUS distribution from the CD-ROM. Use the following command for all machines:

   ```
   cat source/splus.tz | uncompress | tar xvf -
   ```

   where *source* is the path to the CD-ROM drive. (If you are installing as `root`, the above command restores the S-PLUS files with the user and group identifiers stored on the tarfile. On Solaris systems, and perhaps some others, the `o` argument can be used to set these to the identifiers of the user performing the restore.) For example, the following reads the Solaris 2.x binaries from a CD-ROM drive:

   ```
   cat /cdrom/solaris/splus.tz | uncompress | tar xvf -
   ```

   For more details on reading the media, see Step 3, Reading the CD-ROM.

4. (This step is necessary only for new installations, installations on a different host from the previous installation of S-PLUS, or installations that change the number of licensed users.) Run the `HOSTINFO` script from the directory where you installed the S-PLUS files to get the host identification number for your server. Send that number, the name of the hostserver, and all other requested information to MathSoft or your S-PLUS distributor to receive your *license key*. See the section S-PLUS Technical Support on page vii for contact information. You need

the license key for the Élan License Manager, which controls access to S-PLUS. If you purchased S-PLUS for use on multiple servers, get host identification numbers for all of them to receive unique license keys for each server. The license key(s) are input as part of the `INSTALL` procedure. For more details on the `HOSTINFO` script, see Step 4, Getting the Host Information and License Key.

After you receive the license key from MathSoft:

5. *OPTIONAL STEP.* Run the `CONFIGURE` script by typing `./CONFIGURE`. You can successfully install and use S-PLUS without changing any optional settings, *if* you can get root permission. If you want to perform the final installation and you cannot get root permission, you must specify the destinations for the installed files as directories for which you have write permission.

   See Chapter 4, Setting System Defaults, for a description of the items for which you may change defaults or optional settings. Also included are the default values for some of the options, so that you can determine if you need to change any of the defaults. If you do not wish to change any of the defaults, do not perform this step and skip to the next step.

6. Run the `INSTALL` script by typing `./INSTALL` *on the same machine on which you will run the license server* to complete the S-PLUS installation. *You probably need root privilege to perform this step* unless you have modified the destinations for the installed files to specify a directory not owned by `root`. `INSTALL` prompts you for information about your license configuration and, if necessary, your license key.

7. *OPTIONAL STEP.* Run `INSTALL` again on each *licensed* system in your network. You must perform this step only if both of the following conditions hold:

   a. You have licensed S-PLUS for a network.

   b. The directory containing the `Splus5` script is not accessible from each system.

   The typical case is one in which several systems share most file systems, including the file system containing the S-PLUS files, but have separate `/usr` file systems. Running `INSTALL` on each system enables users to run S-PLUS directly from those machines. Thus, S-PLUS users will not have to perform an

`rlogin` or `telnet` command to the machine where S-PLUS was originally installed. This additional step assures that all network users have access to S-PLUS.

Note
Before performing this step, you must first run `INSTALL` on the same server where you intend to run the license server. This should be the server from which you read the media.

8. *OPTIONAL STEP.* Modify your boot sequence so that the S-PLUS license server starts automatically when the computer reboots. This step is optional, but is *highly recommended*. If you or your system administrator do not perform this step, S-PLUS users may have to log in to the server each time they use S-PLUS.

   Modifying the boot sequence is a system-dependent task; some typical cases are described in Step 8, Modifying the Boot Sequence (optional step).

TROUBLESHOOTING INSTALLATION AND LICENSING PROBLEMS

Some installation problems are obvious at the point at which they occur in the installation procedure; others may not manifest themselves until users actually try to work with S-PLUS. For example, if you try to read the S-PLUS CD-ROM into a file system with inadequate free disk space, you get an immediate error. If you forget to set file permissions, you won't see any errors during installation, but the first user who tries to use S-PLUS may get an error. This section describes the most likely problems to arise during installation, how to recognize them, and how to correct them.

Errors in Reading the CD-ROM

The following errors are commonly encountered while reading the CD-ROM:

- Insufficient disk space in selected file system. If you try to read the CD-ROM into a file system with less than 100MB of free disk space, you may encounter the following message from the `tar` command:

  ```
  tar: ./cmd/Sqpe: HELP - extract write error: No space
  left on device
  ```

  Use the `df` command to find a file system with adequate disk space or free the required disk space in the file system you originally specified.

- The CD-ROM drive is not mounted. Before you can read a CD-ROM drive, the drive must be mounted. Mounting the CD-ROM is usually a task for the system administrator, using the `mount` command.

- You extracted the wrong tar file from the CD-ROM. The S-PLUS CD-ROM contains one directory for each platform on which S-PLUS for UNIX is supported, named according to a table in the Release Notes.

Errors from INSTALL

If S-PLUS encounters problems running `INSTALL`, it generates error messages about what went wrong.

Some of the problems you could encounter with the `INSTALL` script are the following:

- On most systems, you must have root permissions in order to install the `Splus` shell script that starts S-PLUS. Use the following command to get root permissions:

  ```
  su
  ```

  Enter the root password if it prompts you.

  If you cannot get root permissions, you can complete installation by using `CONFIGURE` to specify destination directories for which you have write permission.

- On some SunOS computers, the `/usr` file system is mounted read-only. If you are unable to create files in this file system, even with root permissions, consult your system administrator, who can either export the file system with read and write permissions to the desired client or suggest an alternative directory for S-PLUS and the `Splus` script.

- If you are reading S-PLUS files into the `SHOME` for an old version of S-PLUS, you may receive errors if you did not remove the old files. You should clean out the old `SHOME` before attempting to install the new version of S-PLUS. However, we recommend that you create a *new* `SHOME` and install the new version of S-PLUS in that directory.

Problems with the License Manager

Some problems you may encounter with the license manager are the following:

- If you start S-PLUS without a license, you get the message:

  ```
  System terminating: No license server hostname found.
  00 license probably not installed
  ```

  Enter the correct license key number by using the `INSTALL` script and try to run S-PLUS again.

- If you try to start S-PLUS and the license server is down, S-PLUS by default automatically tries to start the license server. You may receive a message similar to the following:

```
Warning: Server down. Trying...Splus LICENSE server
start
```

However, if the environment variable `SLIC_NOAUTOSTART` is set to "`yes`," the automatic restart feature is disabled.

If the attempt is unsuccessful, you may receive the message:

```
Server down. Try 'Splus LICENSE server start' on spud
```

Follow the instructions and run `Splus5 LICENSE server start` on the indicated system (`spud` in this example) or have your system administrator do it for you. If you are on the server that contains the license server system and the license server fails to start, call StatSci support for help. If you are trying to start S-PLUS from a remote server, run the `CONFIGURE` script, check the command for starting the license server from remotes, and manually run the command, substituting the actual server name for the variable `%s` shown in `CONFIGURE`. For example, to start the license manager on `spud` from a remote system, you might use the following command:

```
rsh spud env SHOME=$SHOME Splus5 LICENSE server start
```

- You also get the warning message above if an older version of the license server (such as the one provided with S-PLUS 3.4) is running. In that case, the solution is to run `Splus license server stop` in the old `SHOME`, and to ask your system administrator to change the startup files to start the new license server in place of the older one. The new license server will support older versions of S-PLUS.

- If you try to start S-PLUS and the license server is running, you may receive the message:

  ```
  System terminating: No S-PLUS licenses available
  ```

  By default, the system automatically puts you on a waiting list for the next available license and gives your position in the queue. You can either exit by interrupting S-PLUS (usually by pressing CTRL-C) or continue to wait. When a license is granted, you receive a normal S-PLUS prompt (>) to use the application. If the environment variable `SLIC_NOQUEUE` is set to "`yes`," queuing is disabled.

  If you receive this message, remember that S-PLUS is licensed on a *users per server* basis. This means that each server has a fixed number of simultaneous users. You may not exceed that number

on any server, even if you have unused licenses on other servers in your network. Thus, if you have four licenses on one server and four licenses on a second, and you cannot get a license on the first server, try running S-PLUS from the second server. There may still be licenses available on that server.

- If the license server finishes its 3-minute initialization phase and you receive the message:

  ```
  System terminating: No S-PLUS licenses available...you
  have 5 minutes
  ```

  Save your work up to this point. The system automatically puts you on the queue to wait for the next available license and gives you the choice of exiting or continuing to wait.

- If you are already doing work in S-PLUS, you may suddenly receive the `No licenses available` message if you lose your license for any reason (for example, the license expires or the system administrator takes your license). At this point, a message appears similar to the following (depending on the cause):

  ```
  System terminating: License no longer valid...you
  have 5 minutes...please save work and exit
  ```

  Save your work and exit S-PLUS. If you do not exit S-PLUS but continue working and you reach the 5 minute time limit, S-PLUS gives the message:

  ```
  System terminating: end of grace period for running
  without a license
  ```

  At this point, S-PLUS automatically exits.

- If you are working in S-PLUS and the license server suddenly goes down, you will remain in S-PLUS and be able to continue working.

  Use the command `Splus5 LICENSE server start` to try and initialize the license server.

- If you start S-PLUS, you may receive a message indicating that the license server is not yet ready to give out licenses, as in the following example:

  ```
  Warning: License server is initializing...will
  recheck in 178 seconds
  ```

S-PLUS will try to check out a license after the license server finishes the initialization period. In the meantime, you may continue working in S-PLUS.

- The license manager creates a status lock file in `/tmp`. If the system crashes or the license manager is terminated abruptly, this lock file is left in `/tmp`. If `/tmp` has the "sticky bit" set, license manager start-up will fail with the error:

```
Unable to create status file elmd.6144
```

Permission Errors

If a user encounters the following error:

```
/usr/local/bin/Splus5: /a/herb/files/Splus5.1/cmd/NEW:
permission denied
```

the most likely culprit is that the permissions for the S-PLUS files were not set correctly. It is very important to use the command `umask 022` in the `$HOME` directory to correctly set permissions for the S-PLUS files *before* reading the CD-ROM.

READING THE MEDIA AND OBTAINING A LICENSE KEY

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Step 4: Getting the Host Information and License Key 17

The first part of the S-PLUS installation consists of four steps:

1. Create a top-level directory for S-PLUS. You must have write permission for this directory before you can read the media.

   Before creating this directory, read the instructions in Step 1, Preparing the S-PLUS Top-Level Directory, as there are several important considerations in choosing this directory.

2. Set the UNIX file permissions so that all users can use S-PLUS.

3. Read the S-PLUS distribution media.

4. Run the `HOSTINFO` script from the directory where you installed the S-PLUS files to get the host identification number for your server. Fax the number and all other requested information to MathSoft or your distributor to receive your *license key* for S-PLUS (as well as keys for any add-on modules you may have). You need the license key for the `INSTALL` procedure to enable you to use S-PLUS.

Each of these steps is described in the following sections.

STEP 1: PREPARING THE S-PLUS TOP-LEVEL DIRECTORY

You install S-PLUS in a top-level directory that you create. If your system has an account specifically set up to own S-PLUS, the top-level directory is usually the home directory of that account.

Before you choose the name and location of the top-level directory, consider the following points:

- Make sure that the target file system where S-PLUS is to be installed has at least 100 MB of free disk space available. To check the amount of available disk space on all the available file systems, use the `df` command as follows:

  ```
  df
  ```

  (If mounting is controlled by an automounter daemon, the `df` command will not show *all* available systems.)

- In choosing a file system, never choose a file system with more restrictive naming conventions than the default local file system of the machine for which you purchased S-PLUS. For example, do not install S-PLUS on a file system that restricts file names to 14 characters or all uppercase unless you purchased a version of S-PLUS to run on such a system. If you attempt to do so, the installation procedure issues an explanatory message and will not let you proceed.

- If you are running S-PLUS over a network, make sure to create the top-level `splus` directory on a file system that is available on each system on which you intend to run S-PLUS.

  For example, suppose you want to create the top-level directory on an NFS server named `spud` in its `/users` file system. If you want to run S-PLUS from a workstation named `grace` and you run the `df` command from `grace`, the `spud:/users` directory should appear as one of the mounted file systems. (If mounting is controlled by an automounter daemon, the `df` command will not show all available systems.)

- If you are installing S-PLUS on a dataless client (that is, a machine with its own `/` file system, but with its `/usr` file system on a file server), the directory where S-PLUS is installed must be accessible by the same pathname on both the file server and all dataless clients. To ensure this, run the optional Step 5 and then

examine the `Splus5` shell script created by `CONFIGURE` before running Step 6, `INSTALL`. The `SHOME` environment variable, set at the top of the script, should indicate the directory where S-PLUS was installed. That directory must be accessible, *under that name*, by all machines that will use that `Splus5` shell script to start S-PLUS.

For example, suppose you have a dataless client named `snidely`, and the `SHOME` is shown in the `Splus5` script as follows:

```
/users/splus
```

If you run a `df` command from either the file server or any of its other clients, `snidely`'s file system might appear as `/nfs/snidely/users` in the list of mounted file systems. You must edit the script to specify `/nfs/snidely/users/splus` as the `SHOME`. In some cases, the client (`snidely`, in this example) does not recognize its own `/users` file system under the name `/nfs/snidely/users`. In this case, you should create a symbolic link from `/nfs/snidely/users` to `/users` on the dataless client.

After you have taken the previous items into consideration in choosing your directory location, do the following to create the directory:

1. Pick a file system that has at least 100 MB of available disk space. These instructions assume you pick the */usr/local* file system. If you use a different file system, change the occurrences of */usr/local* in this section to the file system you picked.

2. Change directory to a directory on the file system you picked:

   ```
   cd /usr/local
   ```

3. You may have to use the UNIX `su` command to get permission to write and create directories in the file system you picked. See the UNIX manual page for `su` for more information.

4. Create a directory to hold the S-PLUS directory tree. (These instructions name the directory *splus5*, but you can name it whatever you like. Just substitute the name you want for *splus5* wherever it occurs in this section.)

   ```
   mkdir splus5
   ```

5. Change directory to *splus5*:

   ```
   cd splus5
   ```

You perform the remaining installation steps—setting permissions, reading the CD-ROM, running `HOSTINFO`, optionally running `CONFIGURE`, running `INSTALL`—from this S-PLUS directory.

STEP 2: SETTING PERMISSIONS

Use the UNIX `umask` command to set the proper UNIX file permissions, so everyone on your system can use S-PLUS:

```
umask 022
```

See the UNIX manual page on `umask` for more information.

STEP 3: READING THE CD-ROM

S-PLUS is distributed on a CD-ROM with separate directories for each supported platform—see the Release Notes for the naming conventions. The CD-ROM is formatted according to the ISO 9660 standard, which names all files in UPPERCASE letters. Depending upon how your CD-ROM drive is mounted, and your platform type, you may see file names in any of the following formats:

- UPPERCASE
- lowercase
- UPPERCASE;1

In using the following commands, use the format that matches your system. For example, if the file `solaris/splus.tz` appears as `SOLARIS/SPLUS.TZ` on your system, use uppercase letters in the `cat` command in step 2.

Use the following procedure to read a CD-ROM:

1. Put the CD-ROM into the appropriate drive. Be sure the drive is mounted and note the device name.
2. Read the CD-ROM, using the following `tar` command format:

   ```
   cat tarfile | uncompress | tar xvf -
   ```

   where *tarfile* combines the CD-ROM device name, the platform distribution directory, and the file name. (If you are installing as `root` on a Solaris system, use the `o` argument to set file user and group identifiers correctly.)

   For example, to read the Solaris (SunOS 5.5) distribution, use the following `tar` command:

   ```
   cat /cdrom/solaris/splus.tz | uncompress | tar xvf -
   ```

   It will take about 5 minutes to read the CD-ROM. After it is read, you can continue with the remainder of the installation.

STEP 4: GETTING THE HOST INFORMATION AND LICENSE KEY

This step is required only for new installations, if you will be running S-PLUS on a host different from the one running your earlier installation, or if you are changing the number of licensed users. If you are installing S-PLUS on the same host as an existing installation, your existing information will be used.

After you copy the S-PLUS files to the selected file system, run the `HOSTINFO` command from the top-level S-PLUS directory on the host where the license manager will be run to get the *host identification number* from your server. MathSoft uses this number to generate a *license key* for the license manager that is part of the S-PLUS application.

Type the following to get your **host identification number**:

```
./HOSTINFO
```

The `HOSTINFO` command displays a detailed message, as in Figure 2.1.

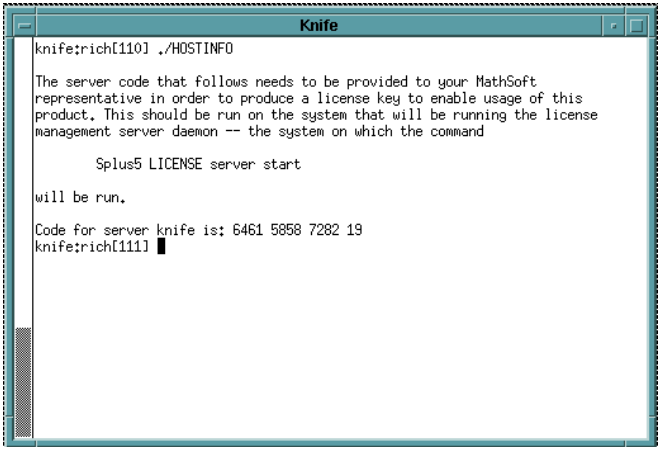
Knife
knife:rich[110] ./HOSTINFO
The server code that follows needs to be provided to your MathSoft
representative in order to produce a license key to enable usage of this
product. This should be run on the system that will be running the license
management server daemon -- the system on which the command
Splus5 LICENSE server start
will be run.
Code for server knife is: 6461 5858 7282 19
knife:rich[111]

Figure 2.1. *Getting the host identification number.*

The **host identification** is the number in the last line of the message. Use this host identification number to obtain your license key from your S-PLUS distributor.

Send all of the following information to MathSoft or your S-PLUS distributor (see the section S-PLUS Technical Support on page vii for contact information):

- the *server name* (the name of the server where you will run the license manager),
- the *hostinfo ID* (the output from the `HOSTINFO` command,
- your S-PLUS serial number,
- your platform type.

Note

You can send (in the same message) host identification numbers for any add-on modules that you purchased along with S-PLUS. Please refer to the installation instructions for those modules for details on getting host identification numbers for each module you have purchased.

Once you send your distributor the request for a license key, you have completed the first part of the S-PLUS installation. Your distributor will return a *license key* to enter when you run the `INSTALL` script, Step 6. Upon receiving your number, proceed with the second part of the S-PLUS installation.

INSTALLING S-PLUS 3

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Step 8: Modifying the Boot Sequence (optional step) **25**

The following four steps are performed after you receive a license key from MathSoft to complete the S-PLUS installation. Three of the steps are optional, however.

1. OPTIONAL STEP. Run the `CONFIGURE` procedure.
2. Run the `INSTALL` script *on the same machine on which you will run the license server* to complete the S-PLUS installation.
3. OPTIONAL STEP. Run `INSTALL` again on each system from which you intend users to run S-PLUS in your network.
4. OPTIONAL STEP. Modify your boot sequence so that the S-PLUS license server starts automatically when the computer reboots.

The sections that follow describe each of these steps in detail.

STEP 5: RUNNING CONFIGURE (OPTIONAL STEP)

This step is optional and enables you to change many defaults from values that MathSoft has chosen. In many cases, you do not need to run this step. If you choose not to run this step at this time, you can run it later to update your installation. We recommend that you read Chapter 4, Setting System Defaults, for more information on some of the parameters which may be changed with the configuration script and what the default values are, so that you may determine whether you need to run `CONFIGURE`.

To start `CONFIGURE`, issue the following command:

```
./CONFIGURE
```

`CONFIGURE` displays a menu showing the available options and prompts you for a selection. At any time, you can get information by choosing the option `About this Menu`.

To exit the `CONFIGURE` script, choose `0`, `Exit CONFIGURE`.

STEP 6: RUNNING INSTALL

In order to run this step with the default options, you probably need `root` *privileges.* If you cannot get `root` privileges, use `CONFIGURE` to specify destination directories for which you have write permission. Then run `INSTALL` *on the same computer in which you want to run the license server.*

Note

By default, the `Splus5` script is installed in the directory `/usr/local/bin`. If you want to change the default directory for the installation files to a directory not owned by root, select `Destinations for Installation Files`, from the Configuration Options menu. Then select `Splus5 shell script` from the Default Destinations for Installation Files menu. You can enter the new directory location where the `Splus5` script will be installed. After entering the path, the new location is displayed as the default.

Warning...

If you skipped the optional Step 5, S-PLUS is installed with all of the defaults supplied by MathSoft, which are adequate for many installations. (The default values are described in Chapter 4, Setting System Defaults.) If you later need to change defaults, you can run the optional Step 5 and then return here and run `INSTALL` again. If you choose not to run `CONFIGURE` at this time and go directly (as `root`) to Step 6, Running INSTALL, you will always have to be logged in as `root` in the future to run `CONFIGURE` to change any defaults.

If you are not currently logged in as `root`, but will install S-PLUS as `root`, type:

```
su
```

If you are prompted for a password, enter the root password. If for any reason you cannot log in as root, see your local system administrator or UNIX expert. (If you used `CONFIGURE` to specify destination directories for which you have write permission, you need not be `root` to complete the installation.)

To run the `INSTALL` script, type:

```
./INSTALL
```

You will be prompted for information on various license issues, including whether you want to share licenses with an earlier installation of S-PLUS, and whether you want to rename the script used to launch the earlier installation. Answer the questions as prompted.

If you have never used S-PLUS before, if this is a new host, or you are changing the number of licensed users, you will have to enter the license key you obtained in Step 4. `INSTALL` runs the `HOSTINFO` script (Step 4) in case you did not run it earlier. You receive the same message that `HOSTINFO` generates, including the host identification (code) in the last line of the message. If you have not yet gotten a license key from your distributor, interrupt the installation by pressing CTRL-C; otherwise, continue with the installation. If you do not have your license key, use the form provided with your shipment and fax the host ID, the name of the hostserver, and all other requested information to MathSoft or your S-PLUS distributor to receive your license key. When you receive your key, execute the `INSTALL` script and proceed with the installation.

Note

If you are simply installing a new license key (because you moved S-PLUS from one machine to another, or you've added more users, or for some other reason), do *not* re-run `INSTALL`. Instead, use the utility `Splus5 LICENSE` with the `install` option. See Updating Your License Key on page 43 for details.

If you continue with the installation, `INSTALL` prompts you with the following message:

```
Please enter your key:
```

Enter the license key number you received from MathSoft or your S-PLUS distributor. This number works only on the system for which it was generated. After you enter the license key, `INSTALL` displays a number of informational messages.

If you get the message `You have successfully installed S-PLUS...Installation complete`, congratulations! You have a working version of S-PLUS installed on your system. If you get error messages while S-PLUS tries to install itself, follow the instructions in Troubleshooting Installation and Licensing Problems on page 6. If, after trying the solutions

suggested there, you still have problems installing S-PLUS, please call your distributor or the MathSoft Technical Support line. See the section S-PLUS Technical Support on page vii for contact information.

Note

When you first start S-PLUS after finishing the installation for updating an old copy of S-PLUS, we recommend that you run the `masked` function to find any old objects having the same names as the new S-PLUS functions and remove or rename those objects. Also, if you attach directories containing your personal functions and libraries to the new S-PLUS session, you should try running some of those functions to see if they are compatible with the new version of S-PLUS.

STEP 7: ADDITIONAL NETWORK NODES (OPTIONAL STEP)

If you installed S-PLUS on a single server but have several network nodes, you will probably want users to access S-PLUS directly from their own systems and not have to perform an `rlogin` or `telnet` command to the machine where S-PLUS is installed.

Thus, you may need to perform the instructions in this section on *each* system that will run S-PLUS. (Of course, only *binary compatible* machines on the network can share the same S-PLUS distribution.)

To enable S-PLUS on additional network nodes, log in on each system from which you want to run S-PLUS and follow these instructions:

1. Change directory to the file system which holds the S-PLUS directory tree.
2. Change directory to the top-level `splus` directory.
3. Run `INSTALL` on this system, following the same instructions as in Step 6, Running INSTALL.

STEP 8: MODIFYING THE BOOT SEQUENCE (OPTIONAL STEP)

This step is optional, but we recommend that your system administrator perform this step to ensure that the license server is automatically started every time the computer reboots. If your system administrator does not perform this step and you try to start S-PLUS, S-PLUS will start the license server automatically. This can result in a long delay before S-PLUS actually starts.

On HP-UX, and other systems derived from BSD UNIX, the system administrator should add the following lines (typically in a file `/etc/rc`, `/etc/rc.local`, or `/etc/rc.config`, but some systems may be different) to the boot file to execute during the boot sequence:

```
[ -r /usr/local/bin/Splus5 ] &&
/usr/local/bin/Splus5 LICENSE server start &&
echo 'Splus5 LICENSE server'
```

The actual location where the above lines should be put in the boot file (in the beginning, at the end, or some other location) is very system dependent.

Note

If you ran the optional `CONFIGURE`, Step 5, and changed the default path for the `Splus5` script destination, the path `/usr/local/bin` in the preceding lines may be different.

If these lines are not added (in the order listed above) to the boot sequence, then S-PLUS may not start unless you log in to the server containing S-PLUS each time you want to use the application. S-PLUS tries to automatically start the license server when it is run but may not always be successful. Adding the above lines will ensure the license server is already started and will help reduce user startup delays.

On System V-based systems, including Solaris 2.x and IRIX, the usual convention is to place a script (like the one that follows) into the directory `/etc/init.d`, then create links to it in the `rc*.d` directories that need to run that script. For normal multi-user use, this is usually the `/etc/rc2.d` directory. For example, you could place the following script in the file `/etc/init.d/Splus5Lic`:

```
#!/bin/sh

#
# Startup for Splus5 license manager
#

case "$1" in
'start') [ -r /usr/local/bin/Splus5 ] &&
         /usr/local/bin/Splus5 LICENSE server start &&
         echo 'Splus5 LICENSE server start'
         ;;
'top') [ -r /usr/local/bin/Splus5 ] &&
         /usr/local/bin/Splus5 LICENSE server stop
         ;;
*)
         echo "Usage: S99Splus5 { start | stop }"
         ;;
esac
exit 0
```

Link the script (with a hard link) to the other directories that need it:

```
ln /etc/init.d/Splus5Lic /etc/rc2.d/S99Splus5
```

The file may be named anything you like, but the format of the names in the `rc*.d` directories is generally along the lines of `S99Splus5`. Remember that the scripts are executed alphabetically and need to start with "S", so that all other system configuration files that need to run before the S-PLUS License Manager starts should be named so as to run before this file.

SETTING SYSTEM DEFAULTS 4

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Installing the S-PLUS Man Page **37**

Installing the less Pager **38**

While installing S-PLUS, you may need to set certain environment variables or specify where the `INSTALL` script puts files. You may want to set defaults for printing help files or for how S-PLUS produces graphics on your printer. All these tasks, and more, are performed using the optional `CONFIGURE` script.

Hint

Running the `CONFIGURE` script is an optional part of the S-PLUS installation procedure. The installation comes with built-in defaults for all of the items described in this chapter. The defaults are probably sufficient for most installations. If, after reading this chapter, you determine that some of the defaults are not appropriate for your installation, you should run `CONFIGURE` and set them appropriately.

If you do not run the CONFIGURE script during installation and perform the installation as root, then later decide that you would like to modify some of these settings, you can run the CONFIGURE script at that time. However, at that time you will need root privilege to run CONFIGURE.

The CONFIGURE script allows you to perform the following actions:

- Set defaults for creating graphics hard copy.
- Specify destinations for some of the S-PLUS installation files.
- Set some defaults for the license manager.
- Install UNIX manual pages for S-PLUS.
- Install the UNIX pager **less** and its manual page.

To run CONFIGURE, you must be in the top-level S-PLUS directory. If you are installing S-PLUS, you should be in that directory already. If S-PLUS is already installed, you can return to the top-level directory by issuing the following command:

```
cd `Splus5 SHOME`
```

To start CONFIGURE, issue the following command:

```
./CONFIGURE
```

The Configuration Options menu appears on your screen.

All the CONFIGURE menus have the same form: a numbered list of options and a prompt at which to enter the desired option (see Figure 4.1). To choose an option, type the number corresponding to the desired option at the prompt.

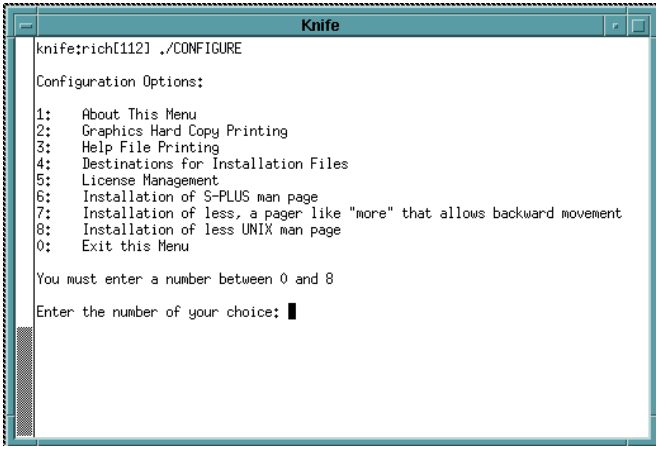
Knife
knife:rich[112] ./CONFIGURE
Configuration Options:
1: About This Menu
2: Graphics Hard Copy Printing
3: Help File Printing
4: Destinations for Installation Files
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice:

Figure 4.1. *A CONFIGURE menu.*

Use Option 0 to leave any CONFIGURE menu. From the top-level menu, this returns you to the UNIX shell. From lower-level menus, it returns you to the next-higher-level menu.

The choices you make with CONFIGURE are not actually installed until you run the INSTALL script. If you want to change your choices before installing them, run CONFIGURE again.

SPECIFYING DESTINATION DIRECTORIES FOR S-PLUS INSTALLATION FILES

If you want to specify a location for the `Splus5` script, select Destinations for Installation Files from the Configuration Options menu.

The Default Destinations for Installation Files menu appears with an option labeled "Splus5 shell script," as in Figure 4.2.

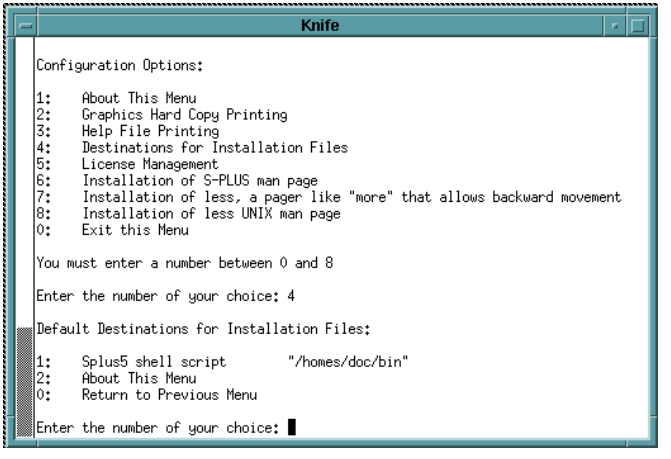
Knife
Configuration Options:
1: About This Menu
2: Graphics Hard Copy Printing
3: Help File Printing
4: Destinations for Installation Files
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice: 4
Default Destinations for Installation Files:
1: Splus5 shell script "/homes/doc/bin"
2: About This Menu
0: Return to Previous Menu
Enter the number of your choice:

Figure 4.2. *Default Destinations for Installation Files menu.*

The default value, which is `/usr/local/bin`, is shown to the right of the label.

To change the `Splus5` script location, choose the option Splus5 shell script by pressing 1 and enter the desired path, as in the following example:

```
/local/bin
```

After you enter the new path, the path appears as the new location. The change does not take effect until you run the `INSTALL` script.

CONFIGURING S-PLUS TO PRODUCE GRAPHICS ON YOUR PRINTER

If you want to specify system-wide defaults for printing your graphics in S-PLUS, select Graphics Hard Copy Printing from the Configuration Options menu. The Setting Print Defaults menu appears as in Figure 4.3.

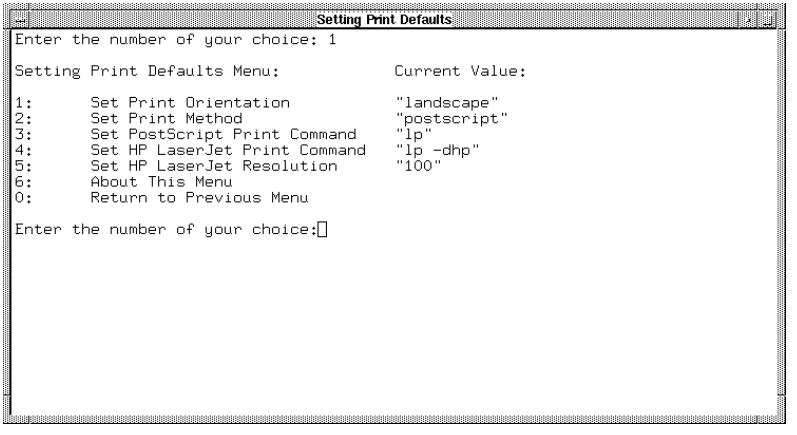
Setting Print Defaults
Enter the number of your choice: 1
Setting Print Defaults Menu: Current Value:
1: Set Print Orientation "landscape"
2: Set Print Method "postscript"
3: Set PostScript Print Command "lp"
4: Set HP LaserJet Print Command "lp -dhp"
5: Set HP LaserJet Resolution "100"
6: About This Menu
0: Return to Previous Menu
Enter the number of your choice:

Figure 4.3. *Setting Print Defaults menu.*

After you complete the changes and run the `INSTALL` script, the changes are saved as your default settings. When you call a graphics device and print a graphic, the new settings should be used as your defaults.

Setting the Print Orientation of Your Output

To set the print orientation of your hardcopy output:

1. From the Setting Print Defaults menu, press 1 and press RETURN. The Select the default orientation of Hardcopy Plots menu appears on the screen.
2. To choose the **portrait** orientation (the *x*-axis prints on the short side of the paper), press 2 and press RETURN.
3. To choose the **landscape** orientation (the *x*-axis prints on the long side of the paper), press 1 and press RETURN. The landscape orientation is the default.

Selecting the Type of Output

If you want to set the type of output for your hardcopy output:

1. From the Setting Print Defaults menu, press 2 and press RETURN. The Select the default hardcopy printing method menu appears on the screen.
2. If you have an HP LaserJet or other PCL printer, choose **laserjet** by pressing 2 and then pressing RETURN.
3. To choose the **postscript** printing method, press 1 and press RETURN. The **postscript** method is the default.

Setting the Print Command for Your PostScript or LaserJet Printer

If you are using the PostScript method to print your hardcopy output, choose Set PostScript Print Command by pressing 3 from the Setting Print Defaults menu. You are prompted for a UNIX command that will be used to send PostScript files to your printer. The following example is a typical PostScript print command for Sun and DEC workstations:

```
lpr -r -h
```

The following example is a typical PostScript print command for HP-UX, AIX, and IRIX machines:

```
lp
```

If you are using the LaserJet method to print your hardcopy output, choose Set HP LaserJet Print Command by pressing 4 from the Setting Print Defaults menu. You are prompted for a UNIX command that will be used to send LaserJet files to your printer. The following example is a typical LaserJet print command for Sun and DEC workstations:

```
lpr -Php -r -h
```

The following example is a typical LaserJet print command for HP-UX, AIX, and IRIX machines:

```
lp -dhp
```

Setting the Printing Resolution for Your HP LaserJet Printer

If you have an HP LaserJet or other PCL printer and need to set the default resolution, in dots per inch, do the following:

1. From the Setting Print Defaults menu, press 5 and then press RETURN. The Select a value for HP LaserJet Resolution menu appears on the screen.
2. To choose **75 DPI**, press 1 and press RETURN.
3. To choose **100 DPI**, press 2 and press RETURN. **100 DPI** is the default.
4. To choose **150 DPI**, press 3 and press RETURN.
5. To choose **300 DPI**, press 4 and press RETURN.

Smaller values produce plots with poorer resolution than the higher values, but print more quickly.

CONFIGURING S-PLUS TO PRINT HELP FILES

To specify a print command for printing S-PLUS help files, select Help File Printing from the Configuration Options menu. You are prompted for the UNIX command to use for printing help files, as shown in Figure 4.4.

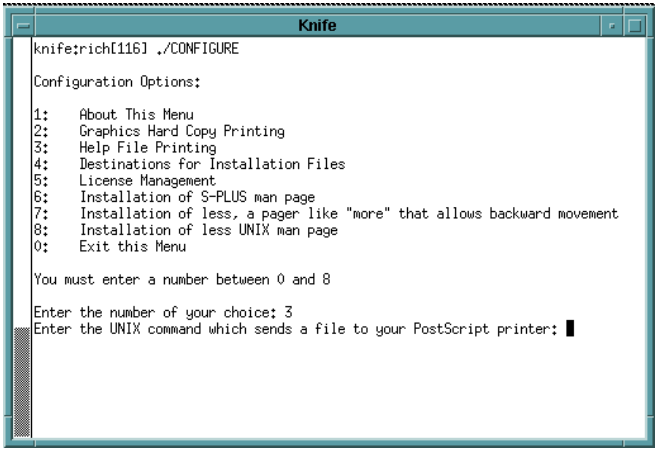
Knife
knife:rich[116] ./CONFIGURE
Configuration Options:
1: About This Menu
2: Graphics Hard Copy Printing
3: Help File Printing
4: Destinations for Installation Files
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice: 3
Enter the UNIX command which sends a file to your PostScript printer:

Figure 4.4. *Specifying a print command.*

SETTING LICENSE MANAGER OPTIONS

If you want to specify options for the license server `logfile` or the 'license server "resources" file, or if you need to set a command to start the license server daemon on a remote system, then use the `License management` option of the Configuration Options menu. You can also set options for the `INSTALL` program to install UNIX manual pages documenting file formats and commands used by the Élan License Manager.

From the Configuration Options menu, press 5 and press RETURN. The License Manager menu appears on your screen, as in Figure 4.5.

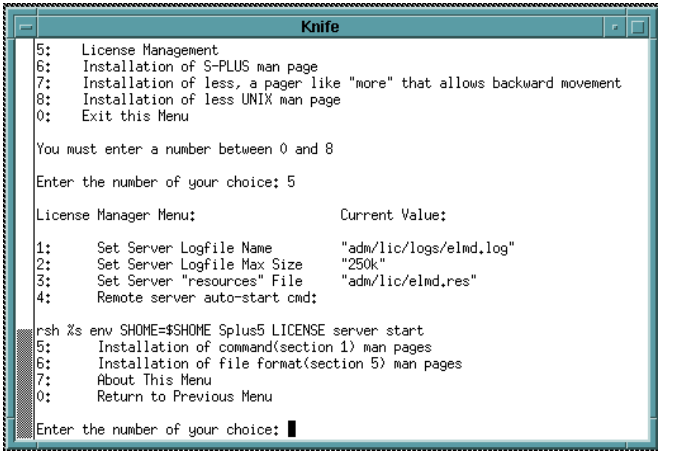
Knife
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice: 5
License Manager Menu: Current Value:
1: Set Server Logfile Name "adm/lic/logs/elmd.log"
2: Set Server Logfile Max Size "250k"
3: Set Server "resources" File "adm/lic/elmd.res"
4: Remote server auto-start cmd:
rsh %s env SHOME=$SHOME Splus5 LICENSE server start
5: Installation of command(section 1) man pages
6: Installation of file format(section 5) man pages
7: About This Menu
0: Return to Previous Menu
Enter the number of your choice:

Figure 4.5. *License Manager menu.*

Setting Log File Options

You can set two options for the license server log file:

1. Set the logfile name as follows:

   a. To choose the `Set Server Logfile Name` option, press 1 and press RETURN. A prompt to enter the name of the license server log file appears on the screen.

   b. Enter the name of the log file with the full directory path or just the name of the file (the path will be relative to `$SHOME`) and press RETURN. For example, `adm/lic/elmd.log`.

2. Set the maximum size of the log file as follows:

   a. To choose the `Set Server Logfile Max Size` option, press 2 and press RETURN. A prompt to enter the maximum size for the log file appears on the screen.

   b. Enter the maximum size of the log file in kilobytes (*e.g.*, 250k) or megabytes (*e.g.*, 2m) and press RETURN. The default is 250k.

Setting the Name of the Server Resources File

The license server resources file contains the resource descriptions for configuring the license server daemon(s). Set the name of the resources file as follows:

1. To choose the `Set Server "resources" File` option, press 3 and press RETURN. A prompt to enter the name of the resources file appears on the screen.

2. Enter the name of the resources file, either the full directory path or relative to `$SHOME` and press RETURN. For example, `adm/lic/elmd.res`.

Setting the Auto-start Command for Remote Servers

The auto-start command for remote servers starts the license server on a remote system. To set this command, do the following:

1. To choose the `Remote server auto-start cmd` option, press 4 and press RETURN. A prompt to enter the command to start a remote license server appears on the screen.

2. Enter the command to start the license server on a remote server and press RETURN. For example, enter:

   ```
   rsh %s env SHOME=$SHOME Splus5 LICENSE server start
   ```

   The `%s` argument is the remote server name where the license server will be started.

INSTALLING THE S-PLUS MAN PAGE

To specify a location for the S-PLUS man page, select Installation of S-PLUS man page from the Configuration Options menu. You are prompted for the path to the directory in which to install the man page, as shown in Figure 4.6.

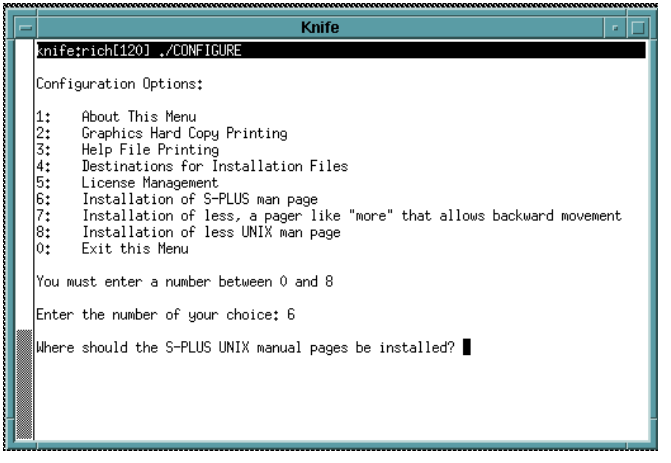
Knife
knife:rich[120] ./CONFIGURE
Configuration Options:
1: About This Menu
2: Graphics Hard Copy Printing
3: Help File Printing
4: Destinations for Installation Files
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice: 6
Where should the S-PLUS UNIX manual pages be installed?

Figure 4.6. *Installing the S-PLUS man page.*

INSTALLING THE LESS PAGER

The less program is a file pager that helps you look at UNIX ASCII files. Similar to the more pager, it allows you to reverse the direction of paging, and move through the file using standard vi commands.

The Configuration Options menu has options for installing both less and its man page.

To install less, choose Installation of less from the Configuration Options menu. You are prompted for the path to the directory in which to install the pager, as shown in Figure 4.7.

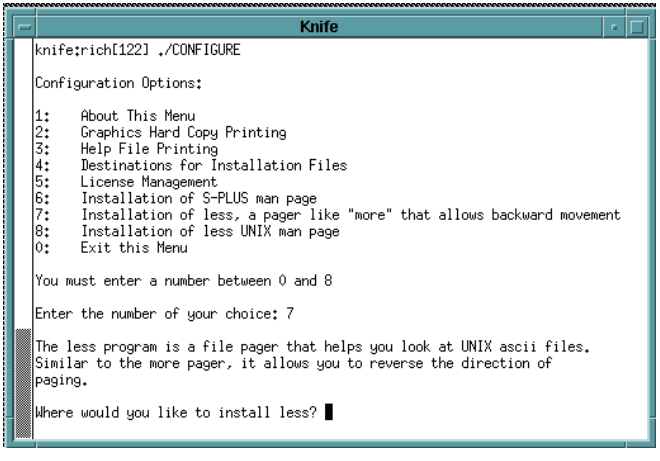
Knife
knife:rich[122] ./CONFIGURE
Configuration Options:
1: About This Menu
2: Graphics Hard Copy Printing
3: Help File Printing
4: Destinations for Installation Files
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice: 7
The less program is a file pager that helps you look at UNIX ascii files.
Similar to the more pager, it allows you to reverse the direction of
paging.
Where would you like to install less?

Figure 4.7. *Installing the less pager*

To install the less man page, choose Installation of less UNIX man page from the Configuration Options menu. You are prompted for the path to the directory in which to install the man page, as shown in Figure 4.8.

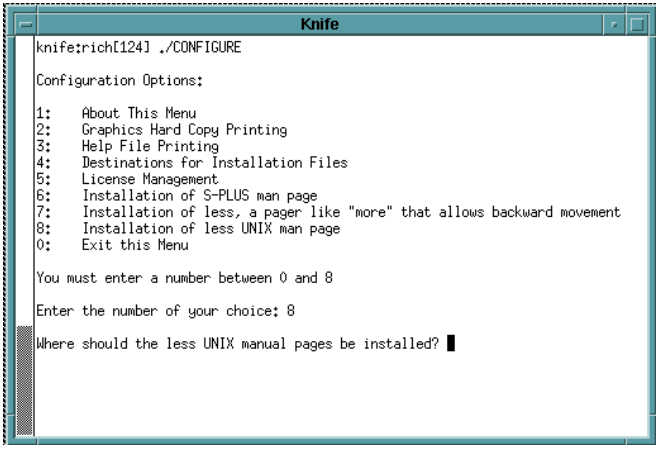
Knife
knife:rich[124] ./CONFIGURE
Configuration Options:
1: About This Menu
2: Graphics Hard Copy Printing
3: Help File Printing
4: Destinations for Installation Files
5: License Management
6: Installation of S-PLUS man page
7: Installation of less, a pager like "more" that allows backward movement
8: Installation of less UNIX man page
0: Exit this Menu
You must enter a number between 0 and 8
Enter the number of your choice: 8
Where should the less UNIX manual pages be installed?

Figure 4.8. *Installing the less man page.*

MANAGING YOUR S-PLUS LICENSES

5

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The Élan License Manager (ÉLM) is a software package that controls access to the S-PLUS software. The S-PLUS utility `LICENSE` gives you control over the license manager. The defaults specified for the license manager should be all you need to effectively run S-PLUS. Using `LICENSE` is optional and is not necessary to use S-PLUS. The primary licensing tasks are handled during the S-PLUS installation procedure. However, `LICENSE` allows you to perform routine management tasks, such as viewing summaries of licensed users or seeing how often S-PLUS is accessed.

For example, you may want to display a report of daily license activity:

```
Splus5 LICENSE rpt -d
```

In the preceding call, `rpt` is an ÉLM function requesting a report and `-d` is an optional command argument specifying a "daily" `rpt`.

To use the license manager, you should understand the terms *feature* and *alias*. A *feature* is an item that is licensed through the Élan License Manager. An *alias* is used to translate a license feature value into a product name. For example, a *feature* `OO` can have an alias (representing a product) called **S-PLUS**. You use feature values with `Splus5 LICENSE` commands such as `notify` and `usage`. However, aliases are easier to understand and, if they are specified, will be printed when you generate license manager reports.

STARTING AND STOPPING THE LICENSE SERVER

Once you create the key file, you are ready to start the license server on the current host. The `server start` command starts the license server on the current system:

```
Splus5 LICENSE server start
```

This enables the license server and allows you to use S-PLUS.

Note
The preceding command is unnecessary if you followed Step 8, Modifying the Boot Sequence (optional step), as part of the installation process.

Use the `server stop` command to stop the license server on the current system:

```
Splus5 LICENSE server stop
```

Note
This command requires system administrator privileges.

You can restart the license server using the `server start` command. To see the current status of each license server on the network, use the `server status` command, as follows:

```
Splus5 LICENSE server status
```

You receive the name of the license server and its current status. To see the name of the license server host for the version of S-PLUS you are using, use the `server host` command, as follows:

```
Splus5 LICENSE server host
```

You receive the name of the server host.

VALID LICENSE COMMANDS AND COMMAND ARGUMENTS

The license manager program includes commands to list the status of all licenses on all outstanding servers, install license keys, identify hosts, view license activity, and much more. The following sections summarize valid license commands and the available command options.

Getting the Host Identification Number

You need the host identification number to get the license key from MathSoft or your S-PLUS distributor. When performing an installation, use the `HOSTINFO` script, which can only be run from the top-level directory. If you are upgrading your license and have already installed S-PLUS, use the `LICENSE hostinfo` command to get your host identification number. When you furnish this number to MathSoft or your distributor, a license key will be generated for the system to be a license server. Run `HOSTINFO` from the directory where you installed the S-PLUS files. Conversely, the `LICENSE hostinfo` command can be run from any directory. The following example shows how to use the `LICENSE hostinfo` command:

```
Splus5 LICENSE hostinfo
```

Send the returned identification number and other requested information to Mathsoft or your distributor. See the section S-Plus Technical Support on page vii for contact information.

Updating Your License Key

Use the `install` command to update your license key whenever you do any of the following:

- Upgrade from a demo license to a normal license.
- Change the number of licenses.
- Change the server on which S-PLUS is installed.

You use `install` as follows:

```
Splus5 LICENSE install
```

You receive a prompt for the license key. The license key is a number obtained from MathSoft or your distributor in response to information provided by you and the `HOSTINFO` command.

Note
Make sure you install your license key on the same server where you acquired your host identification.

Notify Users of License Availability and Expiration

If you want to be notified when there are available licenses, use the `notify` command of `Splus5 LICENSE` to notify you when a license becomes available.

For example, if S-PLUS is feature `00`, the following command notifies you when an S-PLUS license becomes available:

```
Splus5 LICENSE notify -f -m 00
```

The `-f` argument specifies that the license manager should check periodically or until a license becomes available. Without the `-f` argument, `notify` checks for the condition once and then exits. The `-m` argument sends mail to you. The same `LICENSE` command appears more natural if an alias is used for the feature:

```
Splus5 LICENSE notify -f -m S-PLUS
```

You can send mail to another user by using the `-u` flag to `notify`. For example, you might want to send your system administrator mail if the license for the S-PLUS feature is within a week of expiration:

```
Splus5 LICENSE notify -m -u sysadm -x 7 00
```

The `-u sysadm` argument specifies user "sysadm." The `-x 7` argument specifies 7 days.

Status of Licenses on the Network

Occasionally, you may want to view the current users of S-PLUS and all outstanding licenses for S-PLUS. The `users` command lists user names, machines, X11 displays, start times, and group names. The following call lists all the desired information for S-PLUS users on the network:

```
Splus5 LICENSE users
```

The output should look similar to the following:

```
Server thyme:
 CID   LID User                      Feature  Group  Started
 ---   --- ------------------------ -------  -----  ------------
S  1   1   pat@thyme                S-PLUS   -      Oct  6 13:37
S  2   2   silvia@snidely jibe:0.0  S-PLUS   -      Oct  6 09:35
S  3   3   kjh@grouper,olivia:0.0   S-PLUS   -      Oct  6 13:39
S  4   4   deborah@grouper,hoki:0   S-PLUS   -      Oct  6 10:40
S  5   3   kjh@grouper,olivia:0.0   S-PLUS   -      Oct  6 10:59
S-PLUS [00]: 30 licenses, 0 reserved, 4 in use, expires
Nov  7 00:00 1993.
```

Generating Reports of S-PLUS Activity

You may want to generate a report of user activity on S-PLUS in the network. Use the `usage` command with the `-b` argument. The `-b` argument controls the time interval between checks. For example, if S-PLUS is feature `00`, we could check its usage every 30 seconds and generate a report as follows:

```
Splus5 LICENSE usage -b 30 00
```

To turn off the continuous display, press CTRL-C. A sample output might look like the following:

```
License activity on elan:
Feature          in use   total  occupancy
---------------  ------   -----  ---------
S-PLUS     [00]      50      50    100% ****
```

The report lists each feature, the current number of licenses in use, the total number of licenses available, and the current occupancy rate. A high occupancy percentage indicates that it might be wise to purchase additional licenses. A series of asterisks are printed in the right column if the occupancy reaches 100%.

Another license manager command, `rpt`, produces a report of license activity from the license server log file. The following example generates a daily report of the activity for the **S-PLUS** feature:

```
Splus5 LICENSE rpt -d S-PLUS
```

The `-d` argument specifies the daily report. The output might look like the following:

```
Feature    Requests    Issues   Denied   %-Denied
S-PLUS           21        20        1         5%
module          150       115       35        23%
```

The report lists the end feature, the total number of requests for that feature, the number of licenses successfully issued, the number of licenses denied, and the frequency of denied licenses.

The Log File and Resource File

If you need to know the name of the license server log file, use the `logfile` command, as follows:

```
Splus5 LICENSE logfile
```

The `resources` command returns the name of the file containing the license server resource information. The information may include reserved licenses and held license periods. The primary use of the resource file is to set up groups of reserved licenses. The following call displays the name of your license server resource file:

```
Splus5 LICENSE resources
```

You can modify the resource file using any text editor. Refer to the optionally installed `elm_resource(5)` manual page for file syntax and usage details. The License Manager menu of the `CONFIGURE` option provides options for installing the `elm_resource(5)` manual page.

System Administration

MathSoft does not recommend using the `admin` command to perform administrative tasks in the license manager. The important features used to control the license manager are handled by simple calls to `Splus5 LICENSE` and are documented in the preceding sections. The `admin` command allows administrative control of license manager embedded applications. To perform an administrative task, use `Splus5 LICENSE` as follows:

```
Splus5 LICENSE admin [command args]
```

By specifying `command args`, you can access the many options in the administration utility.

The following example shows how to use `admin` with the `-l` argument to list the current users and outstanding licenses available for all features on the network:

```
Splus5 LICENSE admin -l
```

A list displays on your screen containing the desired information.

SETTING MOTIF DEFAULTS 6

Setting the X11 Fonts **49**

Setting Colors for the motif Graphics Device **51**

When S-PLUS is run under the X Window System, Version 11 (or X11), your graphics appear in a graphics window that uses the Motif user interface. You can modify the behavior of this window by setting or modifying *X11 resources*. The `motif` graphics device gets its default values from the system defaults wherever possible, so familiarizing yourself with the way your system sets its window system defaults is helpful for setting S-PLUS defaults. This section describes setting defaults for all users of S-PLUS at your site. Users who want to set their own personal defaults should read Customizing Your S-PLUS Session in the *S-PLUS User's Guide*.

Motif uses the application defaults file `SPlusMotif` stored in the directory `$SHOME/splus/lib/X11/app-defaults` to set system defaults for each X11 client. You can modify the file to set the defaults for each of the S-PLUS functions that depend on them.

To set the appropriate defaults, you need to start S-PLUS under X11. To do this, start X11 on your X11 server. Bring up a window on the machine you use to run S-PLUS. If this machine is different from your X11 server, you should remotely log in to the machine on which you run S-PLUS, then enter:

```
echo $DISPLAY
```

to see how your `DISPLAY` environment variable is set. The system should respond with something like:

```
unix:0
localhost:0.0
:0.0
server_machine:0
```

where *server_machine* is the name of your X11 server. If the client machine (which runs S-PLUS) is different from the server machine (which runs X11), `DISPLAY` *must* be set to *server_machine*`:0`. If you get an error message, or if the `DISPLAY` environment variable is not set to *server_machine*, use the following command to set it properly:

```
setenv DISPLAY server_machine:0
```

Now make sure that you have permission to create windows on your screen with X11 programs, using the `xhost` command from a window displayed on the X11 server:

```
xhost client_machine
```

where *client_machine* is the machine you use to run S-PLUS. The system should respond with a message like:

```
client_machine added to access control list
```

SETTING THE X11 FONTS

Because there are many implementations of X11, it is difficult to pick a set of fonts available on every system. To check which fonts you have on your system, start X11. If your system has the `xlsfonts` command, you can get a listing of the fonts that are available with the following command:

```
xlsfonts | more
```

Look for the `times-medium` fonts, because S-PLUS tries to use these by default. If you would like to change the default fonts for the S-PLUS X11-based graphics devices, select a family of fonts from the list that `xlsfonts` gives and edit the `$SHOME/splus/lib/X11/app-defaults/SPlus*` files on the client machine that runs S-PLUS that is appropriate for the graphics device you want to set. You may need to use the UNIX `su` command to get permission to edit this file. Look for the section of the file that contains the font specifications:

```
sgraphMotif*fonts :\
                  *-times-medium-r-*-*-8-* \
                  *-times-medium-r-*-*-10-* \
                  *-times-medium-r-*-*-12-* \
                  *-times-medium-r-*-*-14-* \
                  *-times-medium-r-*-*-18-* \
                  *-times-medium-r-*-*-24-* \
```

Substitute the family of fonts you want to use. For example, if you want to use the `vg` family of fonts, you might replace the lines like those listed above with the line below.

```
sgraphMotif*fonts : vg-13 vg-20 vg-25 vg-31 vg-40
```

If the names of the fonts you choose are too long to fit on one line, you can put them on multiple lines by putting a backslash (\) at the end of each line except the last one. Be sure there are no spaces after the backslash.

Note

If you receive an error message like the following:

```
Can't find font: *-times-medium-r-*-18-*
```

when you start any of the X11-based graphics devices, and if you don't have the `xlsfonts` command to tell which fonts your machine has, you might want to use the line:

```
sgraphMotif*fonts : micro iso1.8 serif10 iso1.13 iso.16 iso.20
```

This will set the fonts to a set that is available on most systems.

SETTING COLORS FOR THE MOTIF GRAPHICS DEVICE

Colors for the `motif` graphics device are specified by *color schemes*. The color schemes available by default are listed, along with their definitions, in the file `SPlusMotif`.

The `motif` graphics device supports an unlimited number of online color schemes, so that you can readily change colors without shutting down your `motif` window. You can even define new color schemes from the graphics window, using the Color Schemes menu.

The section of the `SPlusMotif` file containing the color schemes should look something like the following:

```
sgraphMotif*defaultColorScheme : 2
sgraphMotif*colorSchemes : \


name : "Black on White"; \
       background: white; \
       lines: black; \
       text: black; \
       polygons: black h5 white; \
       images: white h16 black \n\
. . .
```

Each line beginning `name :` in this section of the file indicates a new color scheme. The color scheme includes five additional lines that specify the colors, respectively, for background, lines, text, polygons, and images. The color schemes are numbered according to the order in which they are listed in the file, so that the first color scheme listed (in our example, Black on White) is color scheme 1, the next color scheme listed is color scheme 2, and so on.

To specify the default color scheme to be used whenever the graphics device is started, do the following:

1. Change directory to the S-PLUS X11 application defaults directory:

   ```
   cd 'Splus SHOME'/splus/lib/X11/app-defaults
   ```

2. Edit the file `SPlusMotif`.

3. Search for the string "defaultColorScheme".

4. Replace the number following the colon with the number corresponding to the color map you want. If there are any monochrome monitors connected to your network, set the `defaultColorScheme` resource to 1, for the black and white color scheme.

If an individual user sets the colors from the Color Schemes dialog on the `motif` window, the new color scheme overrides all other application default settings, including the color settings in the `SPlusMotif` files. (See the chapter Working with Graphics Devices in the *S-PLUS User's Guide*).

ENHANCING S-PLUS 7

Organizing Your Local Functions with library **54**

Adding Help Files for New Functions **56**

Customizing Startup with .First.local **58**

The enhancements described in this chapter will be effective system wide. If you want to enhance your personal S-PLUS environment, read the chapter Customizing Your S-PLUS Session in the *S-PLUS User's Manual*.

As your users create functions that everyone in your organization will want to use, you need to create a way for them to easily access these functions. With the instructions in this section, you can:

- Use the `library` function to add groups of S-PLUS functions, so that future updates won't remove them.
- Add help files for your new functions and link them to the S-PLUS help system.
- Use the `.First.local` function to run S-PLUS commands every time someone starts a new session.

Hint

We recommend that you not make any changes to system directories. The only function that you should create and add to a system directory is `.First.local`, described in this chapter. When S-PLUS users at your site create their own functions or make system-wide changes, they should use a library. If you ignore this recommendation, and make additional changes to system directories, keep a careful log of how you modify S-PLUS, so that you can restore your changes when you receive the next update.

ORGANIZING YOUR LOCAL FUNCTIONS WITH LIBRARY

The S-PLUS `library` command attaches a directory that contains S-PLUS functions and datasets. This offers a good way to add groups of S-PLUS functions so that everyone on your system can use them. You can create a directory that `library` can use by following these instructions:

1. Create a directory to hold your functions and datasets.

   ```
   mkdir local
   cd local
   Splus5 CHAPTER
   ```

   where *local* is the name you want your library to have.

   You can create this directory almost anywhere on the system. For example, *local* could be created under the directory `/spud/users`. The `lib.loc` argument in the `library` function (used in the next step) makes it easy for S-PLUS to find the *local* directory under `/spud/users`.

Hint

In several early versions of S-PLUS, libraries could be created only in the directory `‘Splus5 SHOME‘/library`, so at many sites local libraries are still created there. However, libraries created under `SHOME` must be carefully protected or moved every time S-PLUS is upgraded. Creating them outside `SHOME` in a permanent location will save you time and potential loss of data in the future.

2. Start S-PLUS and enter a `library` command using your library:

   ```
   > library("local", first=T, lib.loc="libloc")
   ```

3. Create or copy the S-PLUS functions you want, and copy them into your *local* library with a command similar to the following:

   ```
   > assign("my.function", my.function, where=2)
   ```

   where *my.function* is the name of your function.

Any S-PLUS datasets or functions you put into *local*`/.Data` will be available to any S-PLUS user who types:

```
> library("local", lib.loc="libloc")
```

The `lib.loc` argument can be either a character string (as in our example, where `"libloc"` is the path to the directory where you created *`local`*), or a character vector giving several directory paths. You can assign a character vector to frame 0 with the name `lib.loc`, and the `library` function will search any directories named there as well as the default `‘Splus5 SHOME‘/library` directory, without any need to supply the `lib.loc` argument.

You can put such an assignment into your `.First.local` to specify the locations of all local libraries, and simplify your users’ calls to attach those libraries. You can also attach one or more of these libraries at startup for all users system-wide. See “Customizing Startup with .First.local” on page 59 for more information.

ADDING HELP FILES FOR NEW FUNCTIONS

When an S-PLUS function is made available system-wide, a help file should always accompany it. Without a help file, use of the function will probably be limited to those in close contact with the person who wrote it.

The S-PLUS function `prompt` generates a help file outline for any S-PLUS function you specify. The outline includes the correct syntax for the function, as well as the current definition of the function, and headings under which you can supply the following information:

- What the function does.
- A brief description of the function.
- A description of each argument, with the option of specifying both required and optional arguments.
- A description of the value returned by the function.
- "Side effects," which are any effects of the function besides the return of a value.
- The "method" behind the function; that is, how the function works.
- Any references to the literature.
- Cross-references to other help files.
- Keywords. Keywords are used by the S-PLUS help system in assembling its Category and Function menus.

To create a help file:

1. Type `prompt(`*`function_name`*`)` at the `>` prompt, where *`function_name`* is the name of the S-PLUS function for which you are creating the help file. The function must already exist or you get an error message.

   You receive the following message from S-PLUS:

   ```
   created file named function.sgm  in the current
      directory; edit
   the file and move it to the appropriate .Data/__Shelp
       directory
   ```

2. Edit the help file, supplying the preceding information, with the following command:

   ```
   > !vi function_name.sgm
   ```

   Include keywords, if appropriate. Predefined keywords are listed in the help file for `prompt`.

3. Move the completed help file into the directory `__Shelp` under the directory containing the documented function. This directory is created for you when you run `Splus5 CHAPTER`. For example, if you create a help file for a function `myfun` in the `.Data` directory, use the following commands to move the help file:

   ```
   > !mv myfun.sgm .Data/__Shelp/myfun.sgm
   ```

See the section Creating Help Files in the booklet *Getting Started with S-PLUS 5.1* for more details on adding help files for your new functions.

CUSTOMIZING STARTUP WITH .FIRST.LOCAL

The S-PLUS function `.First` lets individual users customize their sessions each time they start S-PLUS. The system-wide version of `.First` is `.First.local`, which gets executed whenever anyone on your system starts S-PLUS. You can use it to print messages, or give your users access to your local versions of S-PLUS functions and data sets.

To create a `.First.local` function, define a function as follows:

```
.First.local <- function(){
    Arbitrary S-PLUS expressions.
    }
```

For example, you could specify the location of available local libraries in a session object named `lib.loc`, and attach one of those libraries. Suppose you have local libraries in the following directories: `/nfs/spud/users`, `/nfs/delta/users`, and `/nfs/flash/usr/local/scode`, and you want all users to have continuous access to the functions in the library `/nfs/flash/usr/local/scode/ourfuns`. Define a `.First.local` as follows:

1. At the S-PLUS prompt, type the following:

   ```
   .First.local <- function() {
       assign("lib.loc", c("/nfs/flash/usr/local/scode",
           "/nfs/delta/users", "/nfs/spud/users"),
           where=0)
       library(ourfuns, first=TRUE)
   }
   ```

   The call to `library` includes the argument `first=TRUE` to ensure that library `ourfun` is searched before the S-PLUS system directories.

2. Save the `.First.local` function into the first system database, `$SHOME/library/splus/.Data`, using the following S-PLUS function call:

   ```
   assign(".First.local", .First.local, where=2)
   ```

3. Remove your personal `.First.local` as follows:

```
rm(.First.local)
```

To put a message about your system support person in your startup sequence, you could supply a `.First.local` as in the following example.

1. Create a file called `message` in the top-level S-PLUS directory with a message about your local support person with this command:

   ```
   vi ‘Splus5 SHOME‘/message
   ```

   Use `vi` to enter a message such as the following:

   ```
   If you have problems with S-Plus, contact:
   Prof. Saknussemm
   Geology Department
   555-8707
   ```

2. To create the following function as your `.First.local` function, type the following as shown at the S-PLUS prompt:

   ```
   .First.local <- function() {
       cmd <- paste("cat ", getenv("SHOME"), "/message",
           sep="")
       invisible(unix(cmd, output=F))
   }
   ```

3. Save the `.First.local` function into the first system database, `$SHOME/library/splus/.Data`, using the following S-PLUS function call:

   ```
   assign(".First.local", .First.local, where=2)
   ```

4. Remove your personal `.First.local` as follows:

   ```
   rm(.First.local)
   ```

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